***Iron Man II - The Chemistry Behind Vibranium***

***Introduction***In Iron Man II Tony Stark's created a new element “vibranium” in order to save his own life. Tony Stark was able to create this new element within the confines of his own home all the while being under a strict timeline. How is this possible? Are his methods even feasible? As chemists, you are being commissioned to learn the chemistry behind Tony's methods so that you may prevent the downfall of your industry. You will need to extend your knowledge of the periodic table and atomic composition to complete your task!



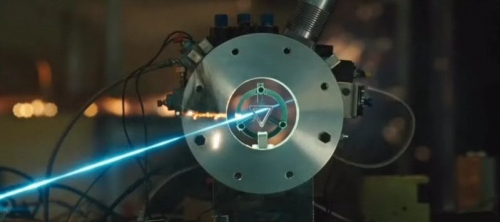
Adapted from Overholser, J. (2011). Iron Man II – The Chemistry Behind Vibranium. Retrieved from: <http://questgarden.com/136/69/9/111201153505/index.htm>

## Task

Your objectives are twofold.

1. You will critique the validity of Tony Stark’s methodology for the creation of “vibranium”.
2. You will create your own element that will make your company shine.

To do this you will need to gain and increase your knowledge and understanding of the following:



* You will enhance and reinforce your understanding of atomic composition.
* You will learn how to analyze the periodic table so that you can calculate the number of protons, neutrons, and electrons in a neutral atom of any given element.
* You will learn and apply the basics behind nuclear fusion and fission.

These objectives will require you to think critically.

Good luck!

**Before your team can achieve what's required of you, you will need to gain some knowledge. Use the hyperlinks provided in this document to aid you in this process.**



## Process

**PART 1: Complete the following two sets of questions. Write both the question, and a complete answer. Upon completion, turn them in to check for mastery!**

1. What is the [**periodic table of elements**](http://www.ptable.com)?
2. What are the [**subatomic particles**](http://www.ndt-ed.org/EducationResources/HighSchool/Radiography/subatomicparticles.htm) that compose an atom? What are the charges associated with these particles and where can these particles be found?
3. What is [**nuclear fusion**](http://science.howstuffworks.com/fusion-reactor.htm)?
4. What is [**nuclear fission**](http://www.atomicarchive.com/Fission/Fission1.shtml)?

**So that your company is assured of your commitment, it is necessary that you are capable of answering the following questions to test your comprehension:**

1. What [**trends**](http://education.jlab.org/qa/pen_number.html) does the periodic table display about neutral atoms in regards to their number of protons, neutrons, and electrons? (HINT: Think about what the atomic number says about an atoms subatomic particles / structure)
2. What are some of the [**similarities and differences**](http://www.diffen.com/difference/Nuclear_Fission_vs_Nuclear_Fusion) between nuclear fusion and nuclear fission?
3. What are some of the [**advantages, disadvantages, and risks**](http://library.thinkquest.org/20331/types/fusion/advant.html) associated with using nuclear fusion as a power source? (Commonly called [**nuclear power**](http://aamjanata.com/nuclear-power-advantages-and-disadvantages-in-india/))

**PART 2: Complete the following two sets of questions, and then complete the chart.**



**Your quest to create a new element is nearing! It is important you practice your atomic composition skills by using the periodic table to identify the number of protons, neutrons, and electrons in neutral atoms of the following elements:**

1. Na 3. H 5. Ar

2. O 4. Zn 6. Au

[**Practice Questions**](http://education.jlab.org/elementmath/index.html) (recommended to click at least 20 questions on the settings).

**To prove that you can predict the products of elements undergoing nuclear fusion, identify the element that would be created if the following combinations of elements were fused together.**

1. Helium (He) and Thorium (Th)  
  
  
  
2. Uranium (U) and Nitrogen (N)

3. Californium (Cf) and Boron (B)

**As part of your data/research, analyze and complete the following chart by providing the missing information. Round the atomic weight to the nearest whole number. (ex. 123.45 would be 123)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Element | Atomic Symbol | Atomic Weight | # of Protons | # of Neutrons | # of Electrons |
| Sodium | Na | 23 | 11 | 12 | 11 |
|  | Zr | 91 |  |  |  |
| Nitrogen |  |  |  |  | 7 |
|  |  | 223 |  | 136 |  |
|  |  | 145 |  |  |  |
|  |  |  | 36 | 48 |  |

**PART 3: Once you've shown mastery in parts 1 and 2, you may continue to your project! Your project is split into two sections: the project/presentation section and then the response to Tony Stark's methods thereafter. You will be graded based on the criteria provided in the rubric.**

**It's time to make your company proud! Like Tony Stark did in the movie Iron Man II, create your own new element using methods of nuclear fusion. The idea behind this is that you want to smash two atoms together using a particle accelerator to create a new, stable element. In addition to combining at least two elements to create your own, you need to complete the following:**

* Provide a name and atomic symbol for your new element.
* Provide the names of the elements you combined to create your new element.
* Provide the number of protons, neutrons, and electrons of your element.
* Calculate its atomic weight.
* List some of the advantages, disadvantages, and applications (uses) of your element.
* Draw a picture of what your element would look like; describe some of the element’s characteristics.

*It is important to note, that your objective is to sell this product, so what are your consumers going to need to know (you are required, BUT NOT limited to providing the information above). You may use a variety of methods to present your information to the class such as powerpoint, poster(s), etc. The presentation needs to be visually appealing.*

**Think about how Tony Stark went about creating the new element of vibranium… in some combination of assorted rooms in his penthouse, without proper/protective clothing. Do you think** [**his methods**](http://www.newscientist.com/blogs/culturelab/2010/04/iron-man-2-science-cures-tony-starks-heartache.html) **were** [**plausible**](http://www.msnbc.msn.com/id/36998742/ns/technology_and_science-innovation/t/iron-man-fiction-tech-behind-him-not/#.Tt5SLHN__rV)**? What about** [**possible**](http://answers.yahoo.com/question/index?qid=20100904212352AA0GM8B)**? Why or why not? What were some of the risks associated in his task? What would you change about his methods? What makes your product better or worse? Address these questions in a three paragraph essay. Once again, you are required, but not limited to answering the above questions!**

## Evaluation

**This is how your project will be evaluated. There are five sections, each valued out of 4. You have a potential to earn a total of 20 points.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Beginning 1** | **Developing 2** | **Qualified 3** | **Exemplary 4** | **Score** |
| **Content & Understanding** | The presentation was missing 3+ of the required parts and/or student showed little-to-no understanding of each. | The presentation was missing 2 of the required parts and/or students displayed poor understanding of each. | The presentation was missing 1 of the required parts and/or students displayed complete understanding of each. | The presentation provided at least all of the required parts, and the students displayed excellent understanding of each. |  |
| **Structure &  Clarity** | The presentation had little-to-no structure that didn't flow and was not clear to the audience. | The presentation had a poor structure that didn't seem to flow and wasn't very clear to the audience. | The presentation had a complete structure that flowed smoothly and was clear to the audience. | The presentation had an exceptional structure that flowed flawlessly and was very clear to the audience. |  |
| **Presentation** | The student did not make eye contact with the audience during the presentation, and/or showed no enthusiasm for the material. | The student made eye contact with the audience for 50% of the presentation, and/or showed little enthusiasm for the material. | The student made eye contact with the audience for only 70% of the presentation, but showed a satisfactory level of enthusiasm for the material. | The student made eye contact with the audience for at least 90% of presentation and showed excellent enthusiasm for the material. |  |
| **Essay Evaluation (Part 1):  Structure** | The essay didn't contain three complete paragraphs and/or displayed little-to-no sentence structure. | The essay didn't contain three complete paragraphs and/or the sentence structure was poor. | The essay contained three complete paragraphs with satisfactory sentence structure. | The essay contained three complete paragraphs with excellent sentence structure. |  |
| **Essay Evaluation (Part 2):  Content** | The essay was not at all focused on the required questions and/or displayed little-to-no critical thinking & evaluation skills. | The essay did not answer all of the required questions and/or displayed poor critical thinking & evaluation skills. | The essay answered all of the required questions and also displayed critical thinking & evaluation skills. | The essay at least answered all of the required questions and also displayed strong critical thinking & evaluation skills. |  |

**TOTAL SCORE: / 20**